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Some Fallacies in the Interpretation of Data Covering Vaccination Against Bang's Disease

R. R. Birch, D.V.M., Ph.D.*

THE new interest in calfhood vaccination against Bang's disease is bringing out some interpretations, both of field observations and experimental data, that require the closest scrutiny if we are to evaluate correctly the effectiveness of artificial immunization. Certain fallacies and half-truths have for years beset the publications dealing with all preventive measures used against the disease, and it may be helpful to point out a few of these as we approach the flood of reports on calfhood vaccination that is sure to appear in the near future.

Standard Fallacy

One standard fallacy, so old and so frequently pointed out that one would hesitate to mention it again were it not still extant, is to limit our observations to the abortion rate, or occasionally to the reproduction record, in a herd before and after vaccination. "There was a high abortion rate in the herd, we vaccinated, and the rate immediately dropped." How often do we hear this statement! It is so easy to fall into the error of comparing only what happened before preventive treatment was applied with what happened afterward, without comparing, as well, what took place afterward with what would have taken place had no preventive treatment been applied. The results of the latter comparison can be approximated only by using enormous numbers of animals over a period of years, or by using controls with lesser numbers. Bang's disease is far too erratic in its effect on the individual, and in its spread through a herd, to lend itself to determinations that would be conclusive if applied to regularly transmissible and highly fatal diseases such as rinderpest and hog cholera.

Exposure

Then, in making our interpretations are we always sure that our vaccinated animals actually have been exposed? It is not enough to know that they have been in contact with blood reactors. For example, we recently tested a herd and found twelve reactors. The chart covering a test made a year previously showed the same twelve reactors. There had been no spread during the entire year, and no preventive measures whatever had been applied. We know that the law of chance gives us, in chronic blood reactors, only about one parturition period in six during which there is spread of Bang bacilli in the discharges from the genital tract at calving time. In this particular herd, although the normal expectation among the twelve reactors would have been two spreaders, there probably had been none, and this brings us to another important point regarding exposure. It must produce extensive spread among controls in order to be accepted as a conclusive test of the immunity of vaccinates.

There are appearing at present certain reports of field herds in which the calves are vaccinated as a routine procedure and the adult groups which eventually receive the vaccinated calves are tested and kept free of blood reactors. The objectives sought are a degree of resistance on the one hand and protection from exposure on the other. These are commendable objectives, even if only partially attained, and the reports are valuable, but they do not provide a safe criterion by which to evaluate the immunity created by vaccination. There is lacking

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known exposure of the vaccinates to a strain of the Bang bacillus proved to be capable of transmitting rapidly from cow to cow.

Data Compilation

In all experimental work, and in compiling data in field herds our selection of the original animals normally will include: limited numbers of solidly immune animals; limited numbers of moderately susceptible animals that contract the disease and recover; large numbers of animals that contract the disease and eventually acquire a degree of tolerance for it, but never recover; and a considerable number of highly susceptible animals that break down rapidly and do not subsequently build up measurable resistance. In selecting animals for experimental purposes one cannot determine in advance which group any particular animal will represent, hence in the selection the law of chance must be allowed full play. This means that numbers are the only protection against gross errors in interpretation, even when controls are used.

In general terms, experimental data covering all phases of Bang's disease, including immunization, have been made defective or valueless through lack of sufficient numbers, while field data have suffered more frequently in interpretation through lack of complete knowledge of the status quo in the beginning, and through the absence of controls.

Inconsistencies

In interpreting the effectiveness of artificial immunization the observed abortion rate often is given too much weight, whereas it is merely one of several important factors. Other essential data include, among both vaccinates and controls, the number of animals actually infected under exposure, the number of spreaders that appear, and the number of live, healthy calves produced during the period of observation.

As one looks back over the vast accumulation of data covering attempts to immunize against Bang's disease, he sees an inconsistent and checkered record. The inherently erratic nature of the disease, leading to some of the distorted interpretations we have mentioned, and to many others equally ill-founded, has been a contributing factor in this confusion. But all the confusion does not derive from faults in interpretation. In addition there have been hit-or-miss plans and practices introducing so many unnecessary factors that a single one cannot be isolated and evaluated. As an example of this tendency, just now we are interested in calfhood vaccination with smooth cultures of Strain 19, but already we are doing violence to methods that would enable us to appraise accurately the value of this strain used, as just indicated, as an immunizing agent. Without extensive knowledge of the pathogenicity of Strain 19 for mature cattle, we are, in the field, crowding its use into this group; without supporting evidence of its value when thus employed we are using it to "immunize" reacting cows, untested cows, even bulls and pregnant cows; and with substantial though inconclusive evidence that in heifers it must be used long before the time of breeding in order to build up maximum resistance, we are constantly shortening the interval between the date of vaccination and the date of breeding. Thus we introduce factors that divert and confuse, and do not clarify. In short, we abuse vaccination.

Looking backward, then, in an effort to extract information from the numerous experiments and experiences covering immunization against Bang's disease, we find much to reject, a little to accept and build on. We see deficiencies, now easily corrected, which have been responsible for at least some of the seeming inconsistencies that have appeared regularly in our publications.

Interpretation of Future Data

Looking forward, if we are to avoid the errors in interpretation that have beset us in the past we will do well, after reading each publication on artificial immunization, to assure ourselves of affir-

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rest of the nervous system through its nervous tracts connecting it with other divisions of the brain. If the cerebral hemispheres in a chicken are removed the animal evidences no marked defect of movement. However, such an animal is not sensitive to light or sound. It will not pick up grain and must be fed. Such an animal can walk around and avoid obstacles. Its ability to perch and maintain its equilibrium is not lost.

BANG'S VACCINATION—

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mative answers to the following questions, or to make due deductions if negative answers are indicated:

1. Have enough animals been used to make sure that the results have not been clouded by the unavoidable selection of natural immunes and semi-immunes?
2. Have sufficient numbers of controls been employed?
3. Do the vaccinates and controls include reasonably well-defined groups as regards age and condition (calves, non-reacting open cows, reacting open cows, etc.)?
4. Has there been natural exposure, capable of infecting controls regularly?
5. Are there accurate data on the blood titer of all animals, on their status as spreaders from the milk and genital tract, on the abortion rate, and on the reproductive efficiency?
6. Has the experiment been continued long enough to provide data on the duration of the immunity that is established?
7. Has the strain used in preparing the vaccine been carefully checked to insure the employment of smooth cultures?

Obviously, these questions do not furnish in detail a complete criterion on which to base our judgment. They do, though, include essential points, for any one of the number, omitted, would seriously diminish or completely destroy the value of an experiment designed to determine the immunizing power of a vaccine.

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